REMARKS

The Office Action dated January 4, 2010 has been received and carefully noted. The following remarks are submitted as a full and complete response thereto.

Claims 1 and 6-8 have been amended to more particularly point out and distinctly claim the subject matter of the invention. Support for the amendment may be found in the specification, for example, at paragraphs [0026], [0054], [0055], and [0057]. No new matter has been added. Therefore, claims 1-8 are currently pending in the application and are respectfully submitted for consideration.

The Office Action rejected claims 1-2 and 4-8 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Hammel et al. (U.S. Patent No. 7,283,494) ("Hammel"), in view of Cousins (U.S. Patent No. 6,618,385) ("Cousins"). The Office Action took the position that Hammel discloses all the elements of the claims with the exception of "wherein the first bandwidth allocation determined in the first node approaches a first optimization condition for the flow," "communicating with the second node to determine a mutually-agreed upon optimal bandwidth allocation when reallocation is needed," and "adopting the mutually-agreed upon optimal allocation for the flow when reallocation is needed," as recited in independent claim 1, and similarly recited in independent claims 6-8 (see Office Action at pages 7-11). The Office Action then cited Cousins as allegedly curing the deficiencies of Hammel. Applicants respectfully submit that said claims recite subject matter neither disclosed nor suggested in Hammel and Cousins.

Claim 1, upon which claims 2-5 are dependent, recites a method of allocating bandwidth in a first node that is operable in an ad hoc, wireless network configured to support at least one guaranteed feasible flow allocation. The method includes the steps of initiating a communication between the first node and a second node in the network that, together, are endpoints of a link, the communication being related to possible bandwidth allocation adjustment of a flow sharing the link, and determining, in the first node, a first new bandwidth allocation that approaches a first optimization condition for the flow. The method further includes the steps of communicating with the second node to determine a mutually-agreed upon optimal bandwidth allocation for the flow, and notifying neighbor nodes in the network of the mutually-agreed upon optimal bandwidth allocation when reallocation is needed, where the neighbor nodes each modify their bandwidth allocation based on the notification. The method further includes the step of adopting the mutually-agreed upon optimal allocation for the flow when reallocation is needed. The at least one guaranteed feasible flow allocation includes at least one flow allocation for which a schedule exists that can realize the at least one flow allocation by taking into account flows in the ad hoc network.

Claim 6 describes a network device configured to allocate bandwidth in an ad hoc, wireless network configured to support at least one guaranteed feasible flow allocation. The device includes a first communication unit configured to initiate a communication between the device and a node in the network that, together, are endpoints of a link in the network, the communication being related to possible bandwidth allocation adjustment of

a flow sharing the link, and a first processing unit configured to determine a first new bandwidth allocation that approaches a first optimization condition for the flow, where the first processing unit is operably connected to the first communication unit. The device further includes a second communication unit configured to communicate with the node to determine a mutually-agreed upon optimal bandwidth allocation for the flow, where the second communication unit is operably connected to the first communication unit, and a third communication unit configured to notify neighbor nodes in the network of the mutually-agreed upon optimal bandwidth allocation when reallocation is needed, where the neighbor nodes each modify their bandwidth allocation based on the notification, and where the third communication unit is operably connected to the first communication unit. The device further includes a second processing unit configured to adopt the mutually-agreed upon optimal allocation for the flow when reallocation is needed, where the second processing unit is operably connected to the first communication unit. The at least one guaranteed feasible flow allocation includes at least one flow allocation for which a schedule exists that can realize the at least one flow allocation by taking into account flows in the ad hoc network.

Claim 7 recites a computer readable medium encoded with a computer program to allocate bandwidth in an ad hoc, wireless network configured to support at least one guaranteed feasible flow allocation, which, when executed, is configured to control a processor to perform a first sub-routine for initiating a communication between the first node and a second node in the network that, together, are endpoints of a link, the

communication being related to possible bandwidth allocation adjustment of a flow sharing the link, and a second sub-routine for determining, in the first node, a first new bandwidth allocation that approaches a first optimization condition for the flow. The computer program, when executed, is further configured to control the processor to perform a third sub-routine for communicating with the second node to determine a mutually-agreed upon optimal bandwidth allocation for the flow, and a fourth sub-routine for notifying neighbor nodes in the network of the mutually-agreed upon optimal bandwidth allocation when reallocation is needed, where the neighbor nodes each modify their bandwidth allocation based on the notification. The computer program, when executed, is further configured to control the processor to perform a fifth sub-routine for adopting the mutually-agreed upon optimal allocation for the flow when reallocation is needed. The at least one guaranteed feasible flow allocation includes at least one flow allocation for which a schedule exists that can realize the at least one flow allocation by taking into account flows in the ad hoc network.

Claim 8 recites a network device configured to allocate bandwidth in an ad hoc, wireless network configured to support at least one guaranteed feasible flow allocation. The device includes initiation means for initiating a communication between the first node and a second node in the network that, together, are endpoints of a link, the communication being related to possible bandwidth allocation adjustment of a flow sharing the link, and determination means for determining, in the first node, a first new bandwidth allocation that approaches a first optimization condition for the flow. The

device further includes determination means for communicating with the second node to determine a mutually-agreed upon optimal bandwidth allocation for the flow, and notification means for notifying neighbor nodes in the network of the mutually-agreed upon optimal bandwidth allocation when reallocation is needed, where the neighbor nodes each modify their bandwidth allocation based on the notification. The device further includes adoption means for adopting the mutually-agreed upon optimal allocation for the flow when reallocation is needed. The at least one guaranteed feasible flow allocation comprises at least one flow allocation for which a schedule exists that can realize the at least one flow allocation by taking into account flows in the ad hoc network.

As will be discussed below, the combination of Hammel and Cousins fails to disclose or suggest all of the elements of the claims, and therefore fails to provide the features discussed above.

Hammel describes a distributed, local determined, channel access protocol that adapts to load, avoids interference and controls access by a group of nodes to a set of shared channels. Shared channel space is divided into a number of communication slots that are repeated at a predetermined interval. Permission to use a slot to communicate between any two nodes is dynamically adjusted by the channel access protocol, which locally estimates load to neighboring nodes, allocates or deallocates slot usage to adapt to load and avoid interference, and asserts and advertises slot usage within an interference area about itself (see Hammel at Abstract).

Cousins describes a network initialization process to determine the maximum available data transfer throughput, optimized bandwidth, and optimized transfer conditions in a wired network (see Cousins at col. 3, lines 42-58). Specifically, the network initialization process also negotiates the number of twisted pair wires to use, detects and identifies scrambled wires, determines the compression scheme to use, etc. These parameters are then utilized in a predetermined well known modulation communications technique such as spread spectrum or Quadrature Amplitude Modulation (QAM) to accordingly adjust the data transfer rate between the two devices. Also, the negotiation session of Cousins seeks to establish the data transfer scheme between the two machines (e.g., how data is transferred over various twisted pair wires) and to determine the best use of the available bandwidth. Accordingly, part of this negotiation includes the selection of compression algorithms for use in the data transfer. Moreover, the negotiation further includes reservation of part of the bandwidth for isocronous data and/or other non-LAN uses such as streaming video (see Cousins at col. 7, lines 40-52).

Applicants respectfully submit that Hammel and Cousins, whether considered individually or in combination, fail to disclose, teach, or suggest, all of the elements of the present claims. For example, the combination of Hammel and Cousins fails to disclose or suggest, at least, "wherein the neighbor nodes each modify their bandwidth allocation based on the notification," as recited in independent claim 1, and similarly recited in independent claims 6-8.

Hammel describes a wireless mesh network. The mesh architecture of the wireless mesh network includes network access concentrators (SNAPs) 103, network access points (NAPs) 101, and network access nodes 102. Network 100 traffic may be routed from a network access node 102 to a neighboring network access node 102. Such a neighboring network access node 102 may route such traffic to one of its neighboring network access nodes 102 and so on until a NAP 101 or a final destination network access node 102 is reached (see Hammel at col. 4, lines 18-30; Figure 1).

Nodes 102, NAPs 101, or a NAP 101 and a node 102, may communicate with each other using point-to-point communication (see Hammel at col. 4, lines 59-62). Specifically, NAPs 101 and nodes 102 communicate with each other by sending and receiving information during short time slots reference to the beginning of a frame (see Hammel at col. 5, lines 7-10). During communication, at a node, a number of communication slots is estimated. The number of communication slots estimated is compared to a number of communication slots currently allocated for communicating with a neighboring node. If the estimated number of slots is less than the currently allocated number of slots, the number of allocated slots is decreased. If the estimated number of slots equals the currently allocated number of slots, then no change in allocation is made. However, if the estimated number of slots is greater than a number of currently allocated slots for communication, slot allocation can be increased. If there are not a sufficient number of free slots to be allocated, then currently allocated slot usage may be overridden based on priority (see Hammel at col. 9, line 59 – col. 10, line 25).

The Office Action took the position that advertising steps 1109 and 1112 of Fig. 11 of Hammel disclose "notifying neighbor nodes in the network of the mutually-agreed upon optimal bandwidth allocation when reallocation is needed" (see e.g., Office Action at pages 4-5). However, Applicants respectfully submit that Hammel fails to disclose that the neighboring nodes of the system in Hammel modify their bandwidth allocation based on the advertising steps 1109 and 1112 of Hammel. Specifically, Hammel discloses that when a slot is allocated, all neighboring nodes are informed of the allocation by communication between the nodes (see Hammel at col. 15, lines 4-22). When a neighboring node receives a slot allocation transmission, a determination is made as to whether the slot allocation pertains to the neighboring node. If the slot allocation does not pertain to the neighboring node, but the transmission associated with the slot allocation is within the node's interference area, then the node advertises to all its neighboring nodes whether one or more neighbors of the slot allocation received the transmission (i.e. step 1109 of Fig. 11). If the slot allocation does pertain to the neighboring node, and it is determined that the slot allocation is not acceptable, then the slot allocation is cancelled, and the cancellation is advertised to all neighboring nodes (i.e. step 1112 of Fig. 11) (see Hammel at col. 15, line 34 – col. 16, line 25). In neither scenario does the neighboring node modify its bandwidth allocation based on the received slot allocation transmission.

Furthermore, Cousins does not cure the deficiencies of Hammel. In the network described in Cousins, before two machines can communicate with each other, network

initialization parameters are utilized by interface adapters 200 of a designated Data Terminal Equipment (DTE) and Data Communication Equipment (DCE) in a negotiation session. The negotiation session establishes the data transfer scheme between the two machines and determines the best use of the available bandwidth (see Cousins at col. 7, lines 40-47). However, Cousins is completely silent with respect to notifying neighboring machines about the negotiation session between the two machines. According to an embodiment of the invention, a notification step which notifies neighbors of a mutually-agreed upon bandwidth allocation allows the neighboring nodes to adjust their own allocations and local schedules on their flows that may interfere with the mutually-agreed upon bandwidth allocation in order to maintain feasibility of an overall network bandwidth allocation. Such a concern is not discussed in Cousins, as Cousins focuses on a determination of a set of optimal transmission parameters for a single link. Therefore, the combination of Hammel and Cousins fails to disclose, or suggest, "wherein the neighbor nodes each modify their bandwidth allocation based on the notification," as recited in independent claim 1, and similarly recited in independent claims 6-8.

For at least these reasons, the combination of Hammel and Cousins fails to disclose, teach, or suggest, all of the elements of independent claims 1 and 6-8.

Claims 2 and 4-5 depend upon independent claim 1. Thus, Applicants respectfully submit that claims 2 and 4-5 should be allowed for at least their dependence upon independent claim 1, and for the specific elements recited therein.

Accordingly, Applicants respectfully request that this rejection be withdrawn.

The Office Action rejected claim 3 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Hammel, in view of Cousins, and further in view of Counterman. The Office Action took the position that Hammel and Cousins discloses all the elements of the claims with the exception of "determining, in a first node, a first new bandwidth allocation that approaches at least one of a Max Min Fair condition and a Quality of Service guarantee condition." The Office Action then cited Counterman as allegedly curing the deficiencies of Hammel and Cousins (see Office Action at page 11). Applicants respectfully submit that said claims recite subject matter neither disclosed nor suggested in Hammel, Cousins and Counterman.

The descriptions of Hammel and Cousins, as discussed above, are incorporated herein. Counterman describes a method and apparatus for a communications system that prioritizes packets that are transmitted over a digital communication channel utilizing at least one error-correcting transmission path associated with a Quality of Service (QoS) objective. The QoS objective is used to select the appropriate transmission path (that may include forward error coding, scrambling, and interleaving) that satisfies the relevant metrics of the desired level of service quality such as packet latency, variation of the packet latency, information throughput, and packet error rate (PER). The communications system selects a transmission path that is associated with QoS objectives best matched to the QoS objectives as required by the originating application (see Counterman at Abstract).

Applicants respectfully submit that the rejection should be withdrawn because Counterman fails to disclose or suggest, at least, "determining, in the first node, the first new bandwidth allocation that approaches at least one of a Max Min Fair condition and a Quality of Service guarantee condition," as recited in claim 3.

The cited portion of Counterman merely discloses that a communications system manages, monitors, and prioritizes packets and allocates bandwidth with a packet network in order to satisfy the QoS objectives associated with the originating application (see Counterman at col. 1, lines 63-66). Applicants respectfully submit that this disclosure is merely a statement of an intended objective and does not enable one of ordinary skill in the art how to determine if a new bandwidth allocation approaches a Quality of Service guarantee condition. In other words, one of ordinary skill in the art would readily understand that are several systems for which one can allocate bandwidth to realize a QoS guarantee condition, but a method for achieving the condition differs from system to system. Furthermore, Applicants respectfully submit that embodiments of the invention, may not only realize QoS objectively, but also may realize fairness objectives in wireless ad hoc networks, a concept not disclosed in Counterman.

Furthermore, claim 3 depends upon independent claim 1. As discussed above, Hammel and Cousins, whether considered individually or in combination, does not disclose, teach, or suggest all of the elements of independent claim 1. Furthermore, Counterman does not cure the deficiencies in Hammel and Cousins, as Counterman also does not disclose, teach, or suggest, at least, "wherein the neighbor nodes each modify

their bandwidth allocation based on the notification," as recited in independent claim 1. Thus, the combination of Hammel, Cousins, and Counterman does not disclose, teach, or suggest all of the elements of claim 3. Additionally, claim 3 should be allowed for at least their dependence upon independent claim 1, and for the specific elements recited therein.

Based on the above discussion, Applicants respectfully submit that the cited prior art references fail to disclose or suggest all of the elements of the claimed invention. These distinctions are more than sufficient to render the claimed invention unanticipated and unobvious. It is therefore respectfully requested that all of claims 1-8 be allowed, and this application passed to issue.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, the applicants' undersigned representative at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper is not being timely filed, the applicants respectfully petition for an appropriate extension of time. Any fees for such an extension together with any additional fees may be charged to Counsel's Deposit Account 50-2222.

Respectfully submitted,

/Keith M. Mullervy/
Keith M. Mullervy
Registration No. 62,382

Customer No. 32294
SQUIRE, SANDERS & DEMPSEY LLP
14^{TH} Floor
8000 Towers Crescent Drive
Vienna, Virginia 22182-6212
Telephone: 703-720-7800
Fax: 703-720-7802

KMM:jf:sew

Enclosures: Petition for Extension of Time